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The Status of Safe Drinking Water Quality in India: Standard, Problems and Removals

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ABSTRACT

Human is aware of the importance of safe drinking water from the ancient times but in present times the rapid growth in industrialization and urbanization has increased the rate of pollution in water, and it became very difficult for natural factors to control this degradation of water. In this situation availability of safe drinking water became major concern, that's why it became very important to study those reasons which lead to rise in water pollution and those deterrent factors which could help to control it. For countries like India, where majority of population is still deceit to basic facilities it becomes more important. We will discuss about the physical, chemical and biological parameters of water, which are responsible for the availability of safe drinking water in this research paper. A part from that there are some others factors also like radioactive, which also cause pollution in the water sources but we mainly discuss above the three parameters. 1) Physical parameters, 2) Chemical parameters, 3) Biological parameters The main objectives of my research paper are (1) Examining the drinking water quality parameters, (2) The status of safe drinking water quality in India, (3) To study about the problems and removals of safe drinking water in India. The paper is based on secondary data. The results be helpful to the policy makers to prepare appropriate polices to make people aware about the usefulness of the quality of the safe drinking water.

Key Words : Quality of drinking water, Safe Drinking water, Standard, Parameters

INTRODUCTION

Human is aware of the importance of safe drinking water from the ancient times but in present times the rapid growth in industrialization and urbanization has increased the rate of pollution in water, and it became very difficult for natural factors to control this degradation of water. In this situation availability of safe drinking water became major concern, that's why it became very important to study those reasons which lead to rise in water pollution and those deterrent factors which could help to control it. For countries like India, where majority of population is still deceit to basic facilities it becomes more important. We will discuss about the physical, chemical and biological parameters of water, which are responsible for the availability of safe drinking water in this paper.

A part from that there are some others factors also like radioactive, which also cause pollution in the water sources but we mainly discuss above the three parameters. 1) Physical parameters, 2) Chemical parameters, 3) Biological parameters

Objectives :

Based on the above background of quality of drinking water, the paper studies the following aspects:

1. Examining the drinking water quality parameters.
2. The status of safe drinking water quality in India.
3. To study about the problems and removals of safe drinking water in India.

METHODOLOGY

The study is based on the analysis of secondary

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data. The data from Central Ground Water Board, Ministry of Water Resources-River Development and Ganga-Rejuvenation Government of India, Central Ground water Board: Dynamic Ground Water Resources of India and The United Nations World Water Development Report 2019 are used for analysis.

RESULTS AND DISCUSSION

Examining the drinking water quality parameters:

Physical Parameters:

Physical parameters can be given in points below:

1) **Turbidity:** When sand, mud, planktons and organic materials dissolves in water, it cause turbidity in water, which stops the proper flow of light in water, and it also create problem at the time of purification of water, a part from this it helps in dissolving other particles.
2) **Temperature:** The most desirable drinking water is consistently cool and does not have temperature fluctuation of more than a few degrees. Groundwater generally meets these criteria and water temperature is also very important for the aquatic life, it controls the reproductive and metabolic rate of living organisms in water. The density of oxygen in water is also affected by it and helps in functioning of bacteria and harmful chemicals. This is an accurate temperature at which aquatic plants and animals survive.
3) **Taste and Odor:** The taste and odor in water is due to the chemical compounds, pollutants and organic activities. Taste helps in detecting the inorganic chemical elements and odor helps in detecting the organic elements.
4) **Color**: Color is also important in physical factors, the quality of water is known through its colors.

Chemical Parameters:

Chemical parameters are also very important for knowing the water quality:

1) **pH:** pH represents the acidity or alkalinity of the water, it shows the balance of positive Hydrogen atom and negative hydroxyl atoms in the water. The pH value of pure water is 7.
2) **Acidity:** Acidity plays an important role in water purity and helps in movement of water from one place to another. As the pH value of acidic water is less the 4.5, it causes rusting in the pipe used for water transporting and affects the aquatic life in water.
3) **Alkalinity:** Alkalinity in water is due to presence of B1- carbonate, carbonate, hydroxide ions and calcium, magnesium, sodium and potassium present in it. The measurement of alkalinity is important because it helps in purifying the polluted or acid rain affected water stream. More alkaline water is very sour in taste and could not be used for drinking and domestic purposes.
4) **Hardness:** Hardness in water shows the dissolving of salts and minerals in very high quantity, Hardness can pollute the water through these ways:

i) Hard water takes more time in heating or boiling, which make its purification process more difficult and complex.
ii) By washing clothes or utensils from hard water, more detergent is used, which causes more water pollution.

5) **Nitrogen** : Nitrogen is necessary for the growth and development of all organisms. Nitrogen in water shows the presence of carbonic elements in water. According to water standard, a definite quantity of nitrogen should be present in the water, if quantity of nitrogen is more in water it got polluted, which is very harmful for human health.
6) **Dissolved Gases:** Different types of gases like- Nitrogen, methane, Hydrogen sulphide carbon dioxide etc. also pollute the water.
7) **Oxygen:** Oxygen through air, spread over water body, oxygen enters into the water by scattering in accurate amount. Oxygen is necessary for maintaining water quality. The decrease in the amount of oxygen, in natural water bodies shows the presence of carbonic elements. Need of oxygen for pure water can be seen through these:

i) **Dissolved Oxygen (DO):** Dissolved Oxygen is an important parameter of measuring purity of water as where the amount of dissolved oxygen is more, the water is more pure. As dissolved oxygen does not affect human health directly but where the amount of dissolved oxygen is less, it would be dangerous for some people.
ii) **Chemical Oxygen Demand (COD):** COD is that amount of oxygen which used for

discomposing of elements in bio- degradable or non- bio- degradable.

iii) **Biochemical Oxygen Demand (BOD):** BOD is that amount of oxygen , which is used for metabolizing bacteria and organic material . In this situation if oxygen is not properly naturally replaced then water get polluted. Use of BOD is the measure of purity in sewages.

8) Dissolved Metallic and Non-Metallic elements: Many metallic and non-metallic materials are also dissolved in water which directly or in directly affect the human health as:

i) **Chloride:** It mainly comes from natural mineral ores, polluted water and industrial waste. It is very harmful for heart and kidney patients, it also harms water pipes.

ii) **Fluoride:** Excess of fluoride in water causes flurosis, in which teeth's get spotted; sometimes it causes bone diseases in children and elderly people.

iii) **Iron and manganese:** Iron and manganese are generally found in ground water, which reacts with air and make water undrinkable.

iv) **Copper and zinc:** If these are present in fewer amount, then it is not so harmful but there excess amount in water, can cause severe effects on human health.

Biological Parameters:

We discuss about bacteria, virus, algae and plankton in biological parameters, which plays important role in maintaining quality of water:-

1. **Virus :** Virus makes water undrinkable, it is responsible for many water – borne diseases like hepatitis, cholera, typhoid, dysentery etc. Apart for this , if there is more virus present in water , then excess amount of chlorine is needed for purification , which cause breathing diseases.
2. **Bacteria:** Bacteria helps in purification of water but excess amount of bacteria in water can cause many diseases also like – cholera, diarrhoea, typhoid and other stomach related diseases.
3. **Algae:** As they prepare their food through the process of photosynthesis and absorb CO_2 and release oxygen, they help in purification of water.
4. **Plankton:** Planktons also naturally helps in water purification, they are indicator of the physical state of the water body. In this way they help in maintain water quality and its purification.

Safe Drinking Water Quality in India: Status, Problems and Removals:

Fresh water availability for drinking, irrigation and other agricultural purposes and other uses is related with the growing demands of modernization, but its availability is decreasing day by day, due to immense rise in population, urbanization, rapid industrialization and irregularity in rains pattern. To get the required amount of fresh water, the dependency upon the ground water is increasing in comparison to surface water, because in summer season most of the surface water bodies get evaporated and do not have the sufficient amount of water, while the ground water sources are easily accessible throughout the year. The groundwater quality is affected by three ways *i.e.* chemical, physical and bacteriological, but the procedure of degradation is very complex and slow. The ground water quality in the phreatic aquifer depends on the nature of rocks, contact time, circulation and temperature. It also depends upon the soluble nature of minerals which are present in the rocks. To some extent the atmospheric precipitation (rain water) is also a major contributory factor for affecting the quality of ground water as during the rain fall most of the gases such as CO_2, SO_2 and NO_2 which are present in the atmosphere gets dissolved in the rain water, during the course of downward travel and percolate down through the earth surface dissolving mainly calcium and magnesium present in the soil forming calcium bicarbonate. The pH value plays an important role in the geochemical reactions as low pH value tends to help in faster dissolution of the minerals within water. The quality of ground water is also affected by the excessive use of fertilizers and pesticides for increasing agricultural production and also for industrial activities. Ground water, due to its long standing with minerals and rocks is generally more mineralized than surface water. This was generally found largely for water in phreatic zones. In pyretic zones the chemical quality of ground water is also badly affected by anthropogenic sources at the ground surface, whether they are domestic, agriculture or industrial.

In India, if we throw the light on the basis of WHO standard quality of safe drinking water, water quality is a major problem of it. Water quality problems are mainly caused by unawareness of environment; therefore the major causes are Pollution and over-exploitation. The rapid industrialization and greater emphasis on increasing

Table 1 : Safe Drinking Water Quality in India: Problems and Removal

Sr. No.	Causes	Details	Affected Area	Impact	Removal Technique
1	Bacterial Contamination	The major pathogenic organisms responsible for water borne diseases in India are bacteria 9E Coli, Shigella, V cholera), viruses (Hepatistis A, Polio Virus, Rota Virus) and parasites (E histolytica, Giardia, hook worm).The Central Pollution Control Board monitoring results obtained during 2005 indicated that organic pollution continues to be predominant in aquatic resources. Organic pollution measured in terms of bio-chemical oxygen demand (BOD) and coliform count gives an indication of the extent of water quality degradation in different parts of the country. It was observed that nearly 66 per cent of the samples had BOD values less than acceptable limits while 44 per cent of the samples indicated the presence of coliform while according to the BIS there should be no coliform in drinking water samples.	Bacterial contamination of water continues to be a widespread problem across the country.	It is a major cause of illness and deaths with 37.7 million affected by waterborne diseases annually.	The common method for eliminating bacterial contamination is to supplement antibiotics into the medium.
2	Contamination Due To Over-Exploitation	In the1980s and 1990s, groundwater tables buckled under increased extraction as water tables started to decline and bore wells ran dry. What was more disturbing was that by then, 80 percent of drinking water sources were groundwater-dependent. As a result, habitations and villages that were covered with a safe water supply by the government started slipping back. Water quality also started becoming a problem. This time, the culprit was not microbial contamination. Drinking water problems began to emerge in places where this was previously unheard of, such as in West Bengal. The problems were chemical in nature, best pointed out in the case of West Bengal. Endowed with 1,650 mm of rainfall and several rivers, West Bengal was earlier using surface water and shallow ponds as drinking water sources. As the state shifted to groundwater sources, reports of arsenic contamination began coming in from the right bank of the Ganga. Other contaminants include excess iron, nitrates and brackishness, the latter especially in coastal areas. Increase in brackishness in coastal areas has been the result of groundwater extraction through deep tube-wells for drinking and irrigation purposes, leading to salinity ingress where seawater seeps in. The occurrence of inland salinity is due to over-extraction of groundwater and less recharge of aquifers. Thus, the problems that emerged from groundwater use were not limited to depleting sources, but also contaminants that did not need to be dealt with before. As of now, the scenario is fearful and alarming. There are a variety of problems that relate to quantity as well as quality. Eighty per cent of our drinking water needs are met by groundwater, which is depleting at an alarming rate, compounded with large scale contamination.	Similarly, over-extraction of groundwater has also resulted in increase in fluoride concentration in the states of Andhra Pradesh, Assam, Gujarat, Karnataka, Madhya Pradesh and Rajasthan.	All water born disease	Save water & harvest rain water

Table 1 contd…

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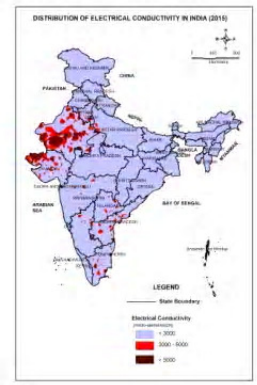
3	Inland Salinity, Coastal Salinity and Salinity 	About 2 lakh sq.km area has been estimated to be affected by saline water of Electrical Conductivity in excess of 4000 µS/cm. There are several places in Rajasthan and southern Haryana where EC values of ground water is greater than 10000 µS /cm making water non potable. Inland salinity is also caused due to practice of surface water irrigation without consideration of ground water status. The gradual rise of ground water levels with time has resulted in water logging and heavy evaporation in semi-arid regions lead to salinity problem in command areas. As per recent assessment about 2.46 m ha of the area under surface water irrigation projects is water logged or threatened by water logging. Coastal areas represent zones where land and sea meet and comprises variety of complex environments including deltas, estuaries, bays, marshes, dunes and beaches. Coastal aquifers have boundaries in contact with seawater and are always under dynamic equilibrium with it. Withdrawal of fresh ground water from these aquifers may result in inequilibrium resulting in intrusion of saline water in coastal aquifers. The Indian subcontinent has a dynamic coast line of about 7500 km length. It stretches from Rann of Kutch in Gujarat to Konkan and Malabar Coast to Kanyakumari in the south to northwards along the Coromandal coast to Sunderbans in West Bengal .The western coast is characterized by wide continental shelf and is marked by backwaters and mud flats while the eastern coast has a narrow continental shelf and is characterized by deltaic and estuarine land forms. Ground water in coastal areas occurs under unconfined to confined conditions in a wide range of unconsolidated and consolidated formations. Normally, saline water bodies owe their origin to entrapped sea water (connate water), sea water ingress, leachates from navigation canals constructed along the coast, leachates from salt pans etc. In general, the following situations are encountered in coastal areas i Saline water overlying fresh water aquifer ii. Fresh water overlying saline water iii. Alternating sequence of fresh water and saline water aquifers. 2000 mg/l	Arid and semi-arid regions of Rajasthan, Haryana, Punjab and Gujarat, Uttar Pradesh, Delhi, Madhya Pradesh Maharashtra, Karnataka, Bihar and Tamil Nadu. In India, salinity problems have been observed in a number of places in coastal areas of the country. Problem of salinity ingress has been noticed in Minjur area of Tamil Nadu and Mangrol – Chorwad-Porbander belt along the Saurashtra coast. In Orissa in an 8-10 km. wide belt of Subarnrekha, Salandi, Brahamani outfall regions in the proximity of the coast, the upper aquifers contain saline horizons decreasing landwards. Salinity ingress is also reported in Pondicherry region, east of Neyveli Lignite Mines.Andhra Pradesh, Chattisgarh, Gujarat, Haryana, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Pondicherry	• Objectionable taste to water. • May affect osmotic flow and movement of fluids	Some of the options available for removal of salinity from drinking water are – i) Electrodialysis ii) Reverse Osmosis iii) Ion exchange

Table 1 contd…

Table 1 contd…

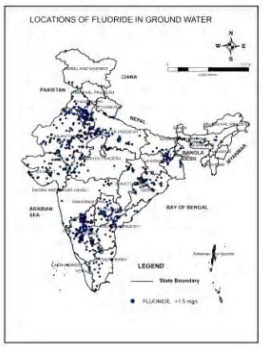
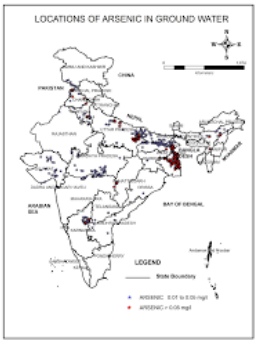
4	Fluoride  	Fluorine is the lightest member of the halogen group of elements. Fluorite (CaF2) is a common fluoride mineral. This mineral has a rather low solubility and occurs in both igneous and sedimentary rocks. Apatite (Ca5 (Cl, F, OH) $(PO_4)_3$,) commonly contains fluoride. Most fluorides are sparingly soluble and are present in natural water in small amounts. High concentration of fluoride in ground water beyond the permissible limit of 1.5 mg/L is a major health problem in India. Nearly 90% of rural population of the country uses ground water for drinking and domestic purposes and due to excess Fluoride in ground water (Table-2), a huge rural population is threatened with health hazards of Fluorosis.	Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal	Immediate symptoms include digestive disorders, skin diseases, dental fluorosis Fluoride in larger quantities (20-80 mg/day) taken over a period of 10-20 years results in crippling and skeletal fluorosis which is severe bone damage	Some of the options available for removal of fluoride from drinking water are – i. Adsorption (Activated Alumina) ii. Ion Exchange iii Nalgonda Technique iv. Membrane (Reverse Osmosis) v. Electro dialysis vi. Alternate Fluoride free aquifer
5	Arsenic  	Arsenic and its compounds are widely used in pigments, as insecticides and herbicides, as an alloy in metals and chemical warfare agents. Though synthetic organic compounds have now replaced arsenic in most of the uses, arsenic is still an element of interest in terms of environmental quality. Arsenic is a metalloid. The common valancy of arsenic in unpolluted ground water of geogenic origin are +III & +V as hydrolysis species the dissociation constant of As (III) and As (V) acids are quite different. The fact that dominant dissolved species are either uncharged or negatively charged suggests that adsorption and ion exchange will cause little retardation as these species are transported along ground water flow path. Organic arsenic compounds such as methyl arsenic acid and dimethyl arsenic acid are not common in ground water. The occurrence of Arsenic in ground water was first reported in 1980 in West Bengal in India. In West Bengal, 79 blocks in 8 districts have Arsenic beyond the permissible limit of 0.01 mg/L. About 16 million people are in risk zone. The most affected districts are on the eastern side of Bhagirathi River in the districts of Malda, Murshidabad, Nadia, North 24 Parganas and South 24 Parganas and western side of the districts of Howrah, Hugli and Bardhman. The occurrence of Arsenic in ground water is mainly in the intermediate aquifer in the depth range of 20-100m. The deeper aquifers are free from Arsenic contamination.	Assam, Bihar, Chhattisgarh, Jharkhand, Tripura, West Bengal, Uttar Pradesh	• Immediate symptoms of acute poisoning typically include vomiting, oesophageal and abdominal pain, and bloody 'rice water' diarrhoea. • Long-term exposure to arsenic causes cancer of the skin, lungs, urinary bladder, and kidney. There can also be skin changes such as lesions, pigmentation changes and thickening (hyperkeratosis)	The remedial options available for getting Arsenic free water are 1. Development of ground water from Arsenic free aquifers 2. Piped water supply from surface water sources. 3. Dilution of ground water with surface water 4. Treatment of ground water for removal of arsenic using adsorption (Activated alumina /Granulated ferric hydrated oxide) or precipitation and coagulation technique. 5. Rain water harvesting

Table 1 contd…

Table 1 contd….

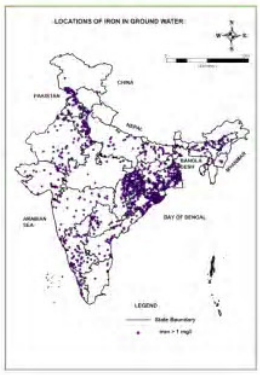
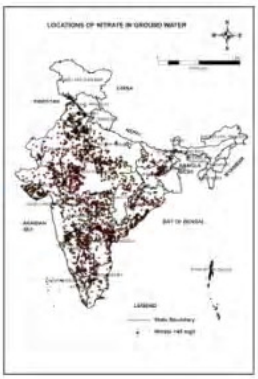
6	Iron 	Iron in an essential element for both plant and animal metabolism. Both ferrous and ferric iron are wide spread minor component of most sediments. Soil development processes result in increase in iron content. The concentration of iron in natural water is controlled by both physico chemical and microbiological factors. In aqueous solution iron is subject to hydrolysis and iron hydroxides are formed during these reactions, especially the ferric form having very low solubility. The reaction of iron in aqueous solution is affected by redox potential and PH of the solution. In natural water, pH mostly ranges from 5 to 9 and as such is not low enough to prevent hydrolysis under oxidising conditions. Practically all the iron is precipitated as hydroxides. This ferric hydroxide may exist in colloidal suspensions in the range of 5 to 8. Organic rich water particularly those with humicacid, can contain dissolved iron over a large range of redox conditions. Organic compounds present in water consume dissolved oxygen which lowers the pH of water because of production of CO_2 reducing both pH and Eh. An additional factor involved in the mobility in iron in ground water is the presence of bacteria. These bacteria are Gallionela, Leptothrix and Thiobacilhus. Decay of these bacteria produces unpleasant odour in the water. High concentration of Iron in ground water has been observed in more than 1.1 lakh habitations in the country. The highest value (49 mg/L) has been found in a hand pump at Bhubaneswar.	Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Jharkhand, Jammu and Kashmir, Karnataka, Kerala, Manipur, Meghalaya, Mizoram, Madhya Pradesh, Maharashtra, Nagaland, Orissa, Punjab, Rajasthan, Sikkim, Tripura, Tamil Nadu, Uttar Pradesh, West Bengal, A&N Islands, Pondicherry	• A dose of 1500 mg/l has a poisoning effect on a child as it can damage blood tissues • Digestive disorders, skin diseases and dental problems	The remedial methods available for removing Iron from drinking water are- 1. Chemical Oxidation 2. Aeration 3. Ion exchange method
7	Nitrates 	Aqueous geochemical behavior of nitrogen is strongly influenced by vital importance of the element in plant and animal nutrition. The most common contaminant identified in ground water is dissolved nitrogen in the form of nitrate (NO3). Nitrate in ground water generally originates from nitrogen sources on the land surface in the soil zone or shallow subsoil zones where nitrogen rich wastes are buried. In some situations nitrate that enters the ground water system originates as nitrate in wastes or fertilizers applied on the land surface. These are direct nitrate sources. In other cases nitrate originates by conversion of organic nitrogen. Ammonification and nitrification are processes that normally occur above the water table generally in the soil zone, where organic matter and oxygen are abundant. Though various nitrogen products are available in the nitrogen cycle, the content of nitrate in Ground Water is probably controlled by nitrification which is directly related to the capacity of soil microorganisms to convert ammonia to nitrate to provide growing plants with the assimilable form of nitrogen. Concentrations of nitrate in the range commonly reported for ground water are not limited by solubility constraints. It moves with ground water with no transformation and / or no retardation. Very shallow ground water in highly permeable sediment or fractured rocks commonly contains considerable dissolved oxygen and in these hydrological environment nitrate commonly migrates large distances from input areas. Nitrate is a very common constituent in the ground water, especially in shallow aquifers. The source is mainly from man made activities.	Bihar, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh	• Causes Methamoglobinemia (Blue Baby disease) where the skin of infants becomes blue due to decreased efficiency of haemoglobin to combine with oxygen. It may also increase risk of cancer.	The remedial methods available for removing Nitrate from drinking water are- 1. Reverse Osmosis 2. Ion Exchange 3. Bio remediation 4. Blending

Table 1 contd…

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8	Heavy Metals	Cadmium – 0.01 mg/ l Zinc – 15 mg/l Mercury – 0.001 mg/ l	Gujarat, Andhra Pradesh, Delhi, Haryana, Kerala	Weakened immunity, abnormal multiplication of cells leading to tumour formation They contain chlorides that cause reproductive and endocrinal damage	Coagulation, ion exchange, reverse osmosis, nano filtration, adsorption and usage of activated alumina.
9	Pesticides	Another major cause for concern is the pollution of ground and surface water from increased fertiliser and pesticide use in agriculture and from industrial sources. The consumption of fertilisers shot up from 7.7 million tonnes in 1984-85 to 13.9 million tonnes in 1994-95 and that of pesticides from 24,305 tonnes in 1974 to 85,030 tonnes in 1994-95. The rise in the usage of such compounds has degraded the quality of surface water resources by causing nitrate contamination. The World Bank has estimated that the total cost of environmental damage in India amounts to US$9.7 billion annually, or 4.5 per cent of the gross domestic product. Of this, 59 per cent results from the health impacts of water pollution. A 1995, a survey undertaken by the Central Pollution Control Board identified 22 sites in 16 states as critical for groundwater pollution due to industrial effluents. There have been instances of heavy metals like lead, cadmium, zinc and mercury being reported in groundwater in Gujarat, Andhra Pradesh, Kerala, Delhi and Haryana.	All state of India	Weakened immunity, abnormal multiplication of cells leading to tumour formation They contain chlorides that cause reproductive and endocrinal damage	Ozone oxidation and granular activated carbon (GAC)[1]
10	Persistent Organic Pollutants	An emerging threat to water quality is due to the use of persistent organic pollutants (POPs). These are chemicals that degrade very slowly and remain in the environment for years. POPs bioaccumulate in the fat tissue of organisms once exposed which meant that they are not excreted from the body. The POPs used widely in India are DDT, with an annual consumption of 10,000 Metric Tonnes; polychlorinated biphenyls used widely in capacitors and transformers and dioxins and furans used in the cement and pipe industry.	Delhi, Himachal Pradesh, Jharkhand, West Bengal, Jharkhand, West Bengal, Himachal Pradesh and Delhi	High blood pressure, hormonal dysfunction, and growth retardation	Coagulation, filtration with coagulation, precipitation, ozonation, adsorption, ion exchange, reverse osmosis and advanced oxidation

- Compiled from: BIS Standards: IS 10500: 1991,
- http://www.ddws.nic.in/popups/submissionfunds-200607-195.pdf
- www.cseindia.org/programme/health/pdf/conf2006/a69industrydelhi.pdf

agricultural productivity including financial and technological constraints and lack of proper law enforcement, have led to generation of large amount of waste and pollutants. Secondly this problem became natural also due to the un even distribution of rainfall. Individual practices also determine the quality of water.

Both point and non-point sources of pollution also help in affecting the water quality. These include sewage discharge, discharge from industries, run-off from agricultural fields and urban run-off. Floods and droughts also affect the water quality and lack of awareness and education among users also make it more polluted. There

1. https://doi.org/10.1080/21622515.2019.1593514

is a need, for active involvement of users in maintaining water quality and other aspects like hygiene, environment sanitation, storage and disposal to maintain the quality of water resources.

Ground water in the shallow aquifers is generally suitable, for use for different purposes and it is mainly containing Calcium bicarbonate and mixed type. However, other water types are also available including water containing Sodium-Chloride. In deeper aquifers the water quality also varies from place to place which is generally suitable for common uses. Only in some cases, ground water has been found unsuitable for specific use due to various contaminations mainly because of geogenic reasons. Table 1 gives the detail causes, affected area, and impact on health and removal techniques.

Conclusion:

The National Water Policy implemented by the government of India in 2002 also emphasizes upon the quality of water and what measures should be used to improve quality of surface as well as ground water. Therefore National Water has focused on both the surface water as well as ground water. In this policy regular monitoring of surface and ground water, including the theory of polluters is processing of polluted water streams, controlling the over use and erosion of water quality to conserve water sources are included. Apart from that it is also expected in this policy to use innovation techniques for better and effective water management. Since this policy emphasizes upon the development of such river basins, so that water quality standards should be maintained throughout all seasons and water quality is assured in the river drainage area. The policy suggests, the pure development scheme and innovation for removing pollutants like arsenic, fluoride and other contaminant and improve quality, dumping grounds for depositing waste materials, so that it's flow in ground water should be controlled, also like this decreasing over use of fertilizers and pesticides so that water quality should be maintained.

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